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An Environmental Survey of the Riverlands Environmental Demonstration Area Encompassing Vegetation, Mussels, Herpetofauna, Fish and Mammals

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Introduction

The U. S. Army Corps Of Engineers (COE), Riverlands Environmental Demonstration Area (EDA) is an example of environmental restoration coupled with development. It was established on land acquired by the COE during construction of the Lock and Dam 26 Replacement (L&D26R). Operation of the new dam, beginning in 1991, raised water levels approximately three meters between river miles 201 - 203. Elevation of river levels and the water table resulted in the permanent inundation of Alton Slough and about 1,200 acres of agricultural lands on the Missouri side of the Mississippi River. The hill and swale topography of the EDA now offers a mosaic of habitats including: a large contiguous backwater, wetland ponds and ditches, mesic prairies and fencerows.

The EDA is the focus of many research studies encompassing a wide variety of physical and biotic factors. Physical investigations include topographic surveys (2 ft. contours), soil surveys, water table monitoring, sedimentation surveys and hydrologic modeling. Biotic investigations, in addition to those described herein, include avian surveys, vegetation surveys and turtle and fish surveys of Ellis Bay. The EDA has also been used as a release site for captive bred Peregrine Falcons and Bald Eagles.

In addition to its utility as an ecological research site the EDA is an important educational and recreational resource for 12 million people in the St. Louis metropolitan area. Educational activities include direct student participation in water quality monitoring, exotic species detection, tree and grass planting; trail building and general ecological investigations. Environmental education workshops for educators are also conducted on site. Recreational opportunities are abundant in the EDA. Popular activities include angling, bird watching, hiking and biking.

This study was initiated to fill gaps in baseline data for the site. Notably lacking from the information base were faunal surveys (mollusks, herpetofauna, fish and mammals) and vegetation surveys along elevation gradients. Results of surveys conducted to fill those gaps are presented.

Study Area

The EDA is located in St. Charles County, Missouri, approximately 20 miles north of St. Louis and directly across the Mississippi River from Alton, Illinois. It includes approximately 1,200 acres including the areas known locally as Ellis Island, Ellis Bay, Teal Pond and the prairie - marsh complex (fig. 1). It lies within portions of sections 26 and 31 of township range T47N and R7E range of the Columbia, MO/IL quadrangle.

The site was converted from agricultural fields in 1990 during construction of the Lock and Dam 26 Replacement. Implementation of the L&D26R raised the water table to 419 ft. MSL at normal pool elevations. The hill and swale topography of the floodplain was inundated to pool elevation and resulted in the formation of many permanent and ephemeral ponds (Fig. 1). The ponds were connected by a series of ditches and control structures. Flow through the system was dependent on pool level manipulations and operation of riverside control structures at the upstream and downstream ends of the EDA.

The hydrology of the area is dependant on rainfall, river levels, groundwater levels and management activities.

Soils are of four major types. They roughly follow topographic gradients.

The EDA includes both terrestrial and aquatic habitats along with the associated ecotonal areas between them. The primary terrestrial habitat consists of mesic tall grass prairie reintroduced on former agricultural lands. Cool grass strips were planted and maintained along roadways and site boundaries to serve as fire breaks for prairie management activities. There is a single fencerow consisting primarily of Osage Orange (*Maclura pomifera*) and various hardwoods.

Aquatic habitats are of three primary types. The first consists of Ellis bay, which is a contiguous backwater of the Mississippi created by operation of the Lock and Dam 26 Replacement. Ellis bay holds water during the majority of the year but sometimes experiences severe drawdowns as a result of dam operation. Submersed aquatic vegetation is absent but natural shorelines support emergent vegetation, primarily smartweed (*Polygonum sp.*). The second type consists of a series of man-made ditches connecting low spots on the floodplain. Ditches are dry, slack water or flowing depending on dam operation and management activities. The third aquatic habitat includes ephemeral and permanent ponds. Ephemeral ponds are numerous and form during periods of heavy rainfall and high river stages. Permanent ponds are maintained by groundwater, which is closely tied to pool water level manipulations. Permanent ponds support both emergent and submersed aquatic vegetation. Ephemeral ponds host a range of wetland and terrestrial plants.

Teal pond is a barrow pit which was to be completely isolated from the river. It was stocked in 1990 with Largemouth Bass (*Micropterus salmoides*), Bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), fathead minnows (*Pimephales promelas*), channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*). It was excluded from fisheries sampling because it was a managed area. Ellis Bay was not included in sampling because it was beyond the scope of this investigation and has been sampled by the Illinois Natural History Survey Long Term Resource Monitoring Program (INHS LTRMP) Pool 26 field station.

Methods

Vegetation

Three 400 meter transects were established in late May in conjunction with the first sampling effort. The first ran east west and was located in the northern portion of the EDA. It traversed elevations ranging between 418 feet MSL to 424 feet MSL and included a portion of a pond/ditch (Fig. 1). The second transect was oriented north south in the central portion of the EDA. It traversed elevations ranging from 418 feet MSL to 428 feet MSL and included a portion of a temporary pond (Fig. 1). The third transect was oriented east west in the southern portion of the EDA. It traversed elevations ranging from 418 feet MSL to 426 feet MSL and included a portion of a temporary pond/ditch.

Sampling along each transect was to be conducted at forty stations. Stations were to be randomly selected within 2-foot elevation strata to ensure sampling many elevations along the line and to develop species elevation associations. Plant sampling was to consist of identification and density ranking each species within a 1/4 square meter quadrat. Specimens were to be retained in the collections of the INHS LTRMP Pool 26 field station, the Missouri Botanical Garden and the Riverlands Area Office.

Mollusks

Mollusk sampling was prohibited due to severe flooding; methods planned are outlined as they were to be done.

Unionid mussels, zebra mussels and aquatic snails were to be sampled in the upper and lower permanent ponds (WET1 and WET2, Fig. 1) and in ditches. Collection was to be conducted by wading a 10 meter transect and collecting all mollusks within 0.5 meter of the transect. The number of transects was to be determined by pond size and depth. Results were to be reported by relative abundance along the transects sampled.

In lieu of sampling results, results from miscellaneous observations are reported.

Fish

Fish were sampled in the spring (10 June, 1993) and in the summer (26 Aug., 1993) following the flood. Sampling was conducted in the permanent ponds (WET1 and WET2, Fig. 1) during the spring and in the vicinity of the ponds while floodwaters was still high. A 32.5-meter seine was stretched perpendicular from shore and pulled in a 90-degree arc to the shoreline. Specimens were identified and measured in the field or preserved for laboratory identification.

Teal pond and Ellis Bay were not sampled as part of this investigation but data for these areas is available from the Missouri Dept. of Conservation or the INHS LTRMP Pool 26 field station.

Herpetofauna

A number of methods were used to collect reptiles and amphibians between mid February and July when flooding occurred. Road cruising resulted in the capture of many specimens and the identification of anuran choruses. Live specimens were identified, marked, measured and released. Road kills were preserved as vouchers if possible. Approximate locations of choruses were recorded in field notes. Cruising was conducted at morning, mid-day and evening and during rains when applicable.

Baited hoop traps were used to collect turtles. They were baited with sardines or gizzard shad and placed in ponds and ditches in the EDA. Ellis Bay was not sampled but there is data available from the INHS LTRMP Pool 26 field station.

Snakes were sampled by walking various habitats in the EDA in addition to road cruising. Sampling was conducted at day and at night. Flooding

hinders snake sampling.

Reptile and amphibian specimens were identified following Johnson (1987). Scientific and common names also follow Johnson (1987). Marking methodology included toe clips for anurans, scute clipping snakes for individual identification and drilling holes in the marginal scutes of turtles for individual identification.

Snake and anuran sampling was qualitative in an effort to document species presence only; having marked numerous specimens will assist future sampling efforts however. Relative abundance of anuran species was determined by estimating the size and number of male breeding choruses. Turtle sampling, in combination with data from 1992, allowed population estimates for the red-eared slider (*Trachemys scripta elegans*) in Ellis Bay.

Mammals

A list of large mammals sighted in the EDA was assembled through consultation with EDA resource managers, local researchers and local wildlife enthusiasts. The list was augmented by observations of the herpetology, vegetation, fisheries and physical monitoring crews.

Small mammals were collected with snap traps. Sampling was conducted at various sites throughout the EDA (Fig. 1). Sites included dry terrestrial and marshy areas of the EDA. Sampling was planned to be most intense during late summer but was cut short by flooding.

Results & Discussion

Vegetation

Transects were established and sampled during late spring when many species were immature and impossible to identify. Flooding precluded sampling during July and effectively destroyed all of the prairie production during 1993. The entire prairie was inundated between 8 July - about 23 August 1993. Many large pools remained in floodplain swales after the flood subsided. A copy of the Missouri Botanical Garden herbarium collection for the EDA is included in lieu of our sampling results (Appendix A).

The prairie was quickly inundated by floodwaters overtopping the levees isolating the EDA from the Mississippi River. Large mats of dead prairie grass floated out of the EDA. The impacts of the flood on the prairie are of great interest and should be followed up in 1994. The Missouri Botanical Garden, Principia College and the U. S. Fish and Wildlife Service (USFWS) Environmental Management Technical Center (EMTC) have extensive pre-flood data for the EDA which provides a good baseline for follow up investigation of restored wetland prairies.

Mollusks

Flooding prevented mollusk sampling, planned for late summer. Sample areas were not well defined because of pooling in the EDA. Prior observations revealed three species each of mussels and snails (Table 1).

Table 1. Mollusk species encountered from casual observations in the

Riverlands Environmental Demonstration Area.

Common Name	Scientific Name
Unionid Mussels	
Giant Floater	*Anodonta grandis*
Imperfect Floater	*A. imbecilis*
Fragile Paper Shell	*Leptodea fragilis*
Gastropods	
Pond Snail	*Physa heterostropha*
Pond Snail	*P. amplexa*
Swamp Snail	*Lymnaea stagnilis*

Fish

Pre-flood fish sampling captured large numbers of few species: mosquito fish (*Gambusia affinis*), green sunfish (*Lepomis cyanellus*), goldfish (*Carassius auratus*), carp (*cyprinus carpio*) and carp X goldfish hybrids (Table 2). All four species have the ability to tolerate poor water quality and frequently thrive in floodplain wetlands (Pflieger 1975). Post-flood sampling resulted in a diverse catch including 18 species (Table 2).

Flooding provided fish free access to floodplain habitats within the EDA, which resulted in increased species diversity following the flood. The fate of newly introduced species will be determined by their ability to escape back to the river or to survive in the conditions provided by the EDA wetlands. It is likely that most new species will not survive under current water management strategies. It is also likely that most fish will become trapped because there is few escape routes from the EDA to the river. Large flocks of piscivorous birds were observed feeding in isolated ponds throughout the EDA.

Follow up sampling should be conducted in 1994 to assess survival of introduced fishes.

Herpetofauna

No species of salamanders (Salentia) were collected during this survey. Seven species of frogs or toads (Anura), seven species of turtles (Chelonia), and six species of snakes (Serpentes) were collected (Table 3). Among species encountered, the Fowler's Toad, Stinkpot turtle and Midland brown snake were not previously recorded for St. Charles County (Johnson 1987). The Fowlers Toad and Midland brown snake are relatively common and are found in counties north and south of St. Charles County. The record for the Stinkpot turtle represents only the second record for counties north of the Missouri River in Missouri. The other record was collected in northeastern Missouri (Johnson 1987).

Mark and recapture studies initiated during 1992 in Ellis Bay indicate that approximately 1,200 Red-eared sliders inhabit the west shoreline of the bay. Other species were rarely encountered thus prohibiting population estimates. Observations indicate the Common snapping turtle is common and probably the second most numerous turtle species.

Fowler's toads were, by far, the most abundant anuran species in the EDA. They were found killed on roads in large numbers, especially after rain. Newly transformed individuals were so numerous near buildings near the Riverlands Area Office they were considered pests. The Western chorus frog appeared to be the second most numerous anuran species. Many large choruses of long duration were recorded between Februarys to May in flooded portions of the EDA. The Southern Leopard frog appeared to be the third most abundant frog. Significant choruses were heard in ditches and flooded areas. Blanchard's cricket frog, Plains leopard frog and the bullfrog were abundant and the first two formed moderate sized choruses. The bullfrog, a late summer breeder, was sighted often but not heard chorusing. Flooding may prevent or reduce bullfrog breeding this year. The Plains spadefoot is relatively rare and only three choruses were heard.

Flooding inhibited snake sampling but from what sampling was completed, the Eastern garter snake appears to be the most common snake in the EDA. More than 50 individuals were marked and released in 1993. The water snakes (Northern and diamondback) may be more common than indicated by our sampling. Flooding greatly expanded water snake habitat making them difficult to locate. All other snakes were uncommon. A hibernaculum was discovered in a cistern at a former home site on the EDA (Fig. 1). The hibernaculum was apparently used by large numbers of garter snakes and a few Prairie king snakes.

Reptiles and amphibians in the EDA, with the exception of some of the snakes, are dependant on having both aquatic and terrestrial habitat. While the EDA provides both in abundance, certain areas appear to be more critical than others. A dredge spoil pile near Ellis Bay (Fig. 1) is the only location where the Spadefoot toad was found; it is also used by turtles for nesting. The dredge spoil pile was the only location in the EDA not inundated by floodwaters.

Reptiles and amphibians were severely impacted when floodwaters quickly filled the levied area encompassing the EDA. Water levels rose from about 420 feet MSL to 430 feet MSL overnight. The relatively immobile snakes and frogs were engulfed by floodwaters and it is likely many perished in the onslaught of water. We noted large numbers of seemingly exhausted frogs, toads and snakes in the floodwaters. Turtles were noted in the area throughout flooding and immediately after. Further work should be conducted in the next few years to follow post-flood recovery patterns and rates.

Table 4. Herpetofauna reported for St. Charles County, MO (Johnson 1987) and those documented in the Riverlands Environmental Demonstration Area.

Species	Common Name	Presence
	Salientia	
Ambystoma annulata Cope	Ringed salamander	
A. maculata (Shaw)	Spotted salamander	
A. texanum (Matthes)	Smallmouth salamander	
A. tigrinum tigrinum (Green)	Eastern tiger salamander	
Notophthalmus viridescens louisianensis (Wolterstorff)	Central newt	
Plethodon glutinosus (Green)	Slimy salamander	
	Anura	
Scapiopus bombifrons Cope	Plains spadefoot	EDA
Bufo americanus Holbrook	American toad	
Acris crepitans blanchardi (Harper)	Blanchard's cricket frog	EDA
Hyla crucifer Wied	Northern spring peeper	
Hyla chrysoscelis-Hyla versicolor complex	Gray treefrog	
Pseudacris triseriata (Wied)	Western chorus frog	EDA
Rana areolata circulosa (Rice and Davis)	Northern crawfish frog	
R. blairi Mecham et al.	Plains leopard frog	EDA
R. catesbeiana (Shaw)	Bullfrog	EDA
R. palustris Le Conte	Pickerel frog	
R. sphenocephala Cope	Southern leopard frog	EDA
R. sylvatica Le Conte	Wood frog	
	Reptilia	
	Chelonia	
Chelydra serpentina (Linné)	Common snapping turtle	EDA
Chrysemys picta bellii (Gray)	Western painted turtle	EDA
Graptemys pseudogeographica (Gray)	False map turtle	EDA
Terrapene carolina triunguis (Agassiz)	Three-toed box turtle	EDA
T. ornata (Agassiz)	Ornate box turtle	
Trachemys scripta elegans (Wied)	Red-eared slider	EDA
Trionyx spinifer Le Sueur	Eastern spiny softshell	EDA
	Squamata	
Sceloporus undulatus hyacinthinus (Green)	Northern fence lizard	
Eumeces fasciatus (Linné)	Five-lined skink	
	Serpentes	
Carphophis amoenus vermis (Kennicott)	Western worm snake	
Coluber constrictor flaviventris Say	Eastern yellowbelly racer	EDA
Diadophis punctatus arnyi Kennicott	Prairie ringneck snake	
Elaphe vulpina (Baird and Girard)	Western fox snake	
Heterodon platyrhinos Latreille	Eastern hognose snake	
Lampropeltis calligaster (Harlan)	Prairie kingsnake	EDA

L. getulus holbrooki Stejneger	Speckled kingsnake	
Nerodia erythrogaster flavigaster (Conant)	Yellowbelly water snake	
N. rhombifera (Hallowell)	Diamondback water snake	EDA
N. sipedon (Linné)	Northern water snake	EDA
Opheodrys aestivus (Linné)	Rough green snake	
O. vernalis blanchardi Grobman	Western smooth green snake	
Pituophis melanoleucus sayi (Schlegel)	Bullsnake	
Regina grahamii Baird and Girard	Graham's crayfish snake	
Thamnophis proximus (Say)	Western ribbon snake	
T. radix (Baird and Girard)	Eastern plains garter snake	
T. sirtalis (Linné)	Eastern garter snake	EDA
Virginia valeriae elegans Kennicott	Western earth snake	
Sistrurus catenatus (Rafinesque)	Massasauga rattlesnake	

Species reported herein

Anura

Bufo woodhousei fowleri Hinckley	Fowler's toad	EDA

Chelonia

Sternotherus odoratus (Latreille)	Stinkpot	EDA

Serpentes

Storeria dekayi wrightorum Trapido	Midland brown snake	EDA

Mammals

Several species of large mammals were sighted in the EDA (Table 4); they are all common to St. Charles County. Small mammal trapping was not completed due to flooding but some preliminary samples were conducted in early May. Rodent species encountered are presented in Table 4.

Some large mammals are known to have perished in the flood after being caught in the rapidly flooded levees districts. No estimate can be placed on the mortality induced by flooding but it is likely that some of the stronger swimmers and more mobile species (deer, fox, coyote) outran the flood. Small, rather immobile, mammals (rodents) were quickly flooded and probably drown. We noted some mice flooding on mats of dead prairie grass. Post flood observations and rodent sampling should continue to assess recolonization patterns and rates.

Table 3. Mammals reported from St. Charles County, MO (Schwartz and Schwartz 1981) and those encountered in the Riverlands Environmental Demonstration Area.

Species (common name)	Presence
Marsupialia	
Didelphis virginiana (Opossum)	Observed EDA
Insectivora	
Sorex longirostris (Southeastern Shrew)	
Blarina brevicauda (Short-tailed Shrew)	Observed EDA
Cryptotis parva (Least Shrew)	
Scalopus aquaticus (Eastern Mole)	
Chiroptera	
Myotis lucifugus (Little Brown Bat)	
Myotis grisescens (Gray Bat)	
Myotis keenii (Keen's Bat)	
Myotis sodalis (Indiana Bat)	
Myotis leibii (Small-footed Bat)	
Lasionycteris noctivagans (Silver-haired Bat)	
Pipistrellus subflavus (Eastern Pipistrelle)	
Eptesicus fuscus (Big Brown Bat)	Observed EDA
Lasiurus borealis (Red Bat)	
Lasiurus cinereus (Hoary Bat)	
Nycticeius humeralis (Evening Bat)	
Lagomorpha	
Sylvilagus floridanus (Eastern Cottontail Rabbit)	Observed EDA
Rodentia	
Tamias striatus (Eastern Chipmunk)	
Marmota monax (Woodchuck)	
Sciurus carolinensis (Eastern Gray Squirrel)	
Sciurus niger (Fox Squirrel)	Observed EDA
Glaucomys volans (Southern Flying Squirrel)	
Geomys bursarius (Plains Pocket Gopher)	
Castor canadensis (Beaver)	Observed EDA
Reithrodontomys megalotis (Western Harvest Mouse)	
Peromyscus maniculatus (Deer Mouse)	Observed EDA
Peromyscus leucopus (White-footed Mouse)	Observed EDA
Microtus ochrogaster (Prairie Vole)	Observed EDA
Microtus pinetorum (Woodland Vole)	
Ondatra zibethicus (Muskrat)	Observed EDA
Synaptomys cooperi (Southern Bog Lemming)	
Rattus rattus (Black Rat)	
Rattus norvegicus (Norway Rat)	Observed EDA
Mus musculus (House Mouse)	Observed EDA

Zapus hudsonius (Meadow Jumping Mouse).....Observed EDA

Carnivora
Canis latrans (Coyote).....Observed EDA
Vulpes vulpes (Red Fox).....Observed EDA
Urocyon cinereoargenteus (Gray Fox)
Procyon lotor (Raccoon).....Observed EDA
Mustela frenata (Long-tailed Weasel)
Mustela vison (Mink)
Taxidea taxus (Badger)
Spilogale putorius (Eastern Spotted Skunk)
Mephitis mephitis (Striped Skunk).....Observed EDA
Lutra canadensis (River Otter)
Lynx rufus (Bobcat)

Artiodactyla

Odocoileus virginianus (White-tailed Deer).....Observed EDA

Domestic Animals

Canis familiaris (Dog).....Observed EDA
Felis domestica (Cat).....Observed EDA

Summary

The Riverlands Environmental Demonstration Area provided an opportunity to study environmental factors in a restored floodplain prairie ecosystem. These surveys helped fill some of the information gaps in the ecological database for the site. While not quantifying all populations significant new information was obtained to build on in the future. Numerous other environmental studies also add to the wealth of baseline data from which impacts caused by intense flooding during July and August 1993 can be assessed. Future work should be encouraged to document the post-flood recovery of this unique area and to guide future restoration projects.

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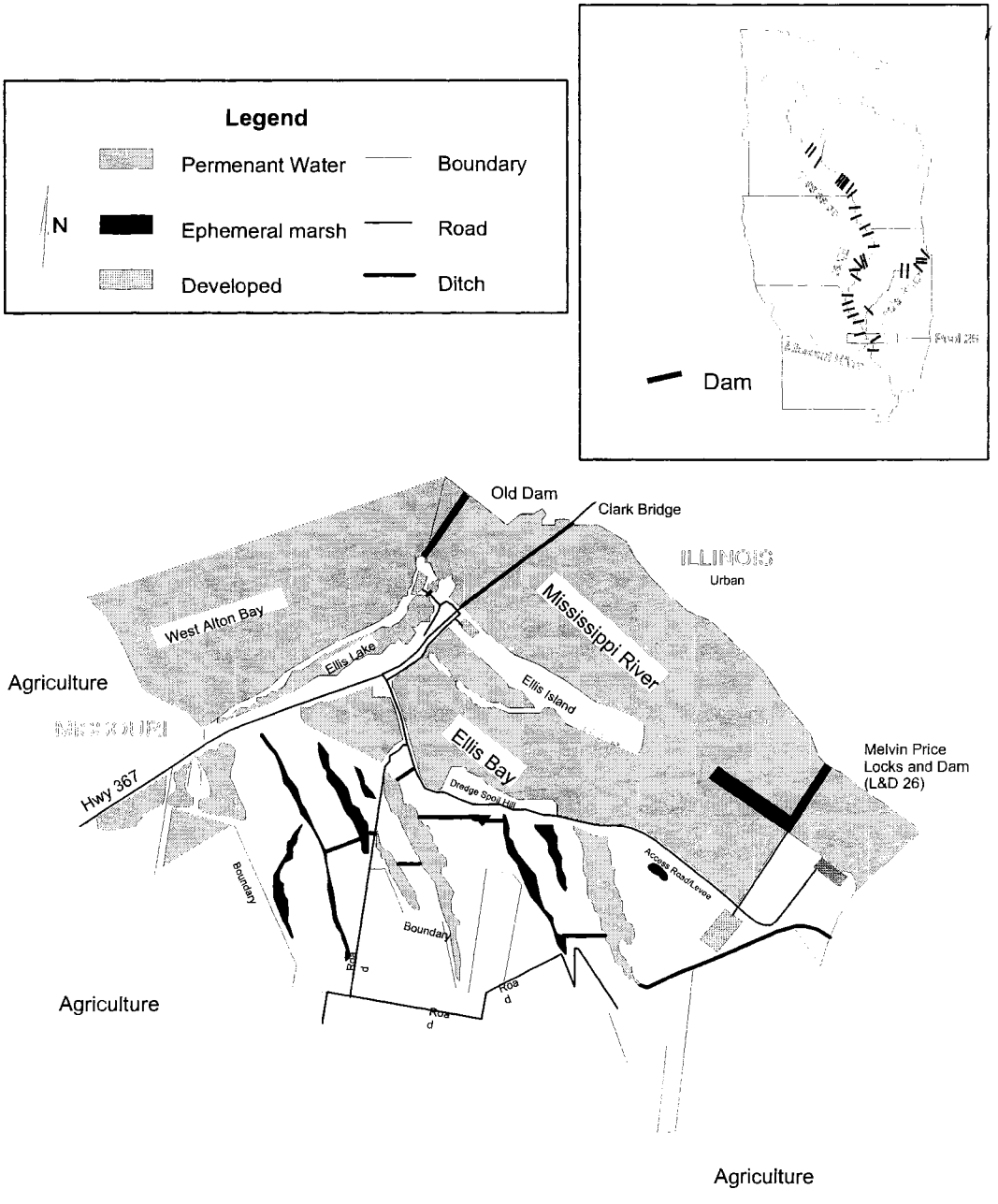
Legend
Permenant Water
Boundary
N
Ephemeral marsh
Road
Developed
Ditch
Dam
Old Dam
Clark Bridge
ILLINOIS
Urban
West Alton Bay
Ellis Lake
Mississippi River
Ellis Island
Agriculture
MISSOURI
Ellis Bay
Dredge Spoil Hill
Hwy 367
Melvin Price
Locks and Dam
(L&D 26)
Access Road/Levee
Boundary
Boundary
Road
Road
Road
Agriculture
Agriculture